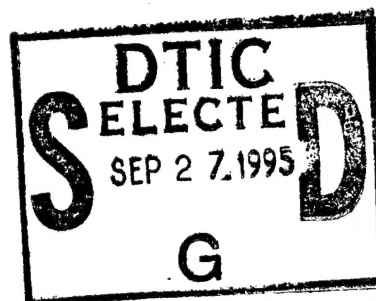


DEVELOPMENT OF AN ULTRA-SAFE RECHARGEABLE
LITHIUM-ION BATTERY



Contract # N00014-94-C-0141
ARPA Order # 9332004arp01/13 APR 1994/313ES

R & D Status Report #3

Reporting Period: 16 December 1994 - 15 January 1995

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Submitted by:

The Electrofuel Manufacturing Company Inc.

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DEVELOPMENT OF AN ULTRA-SAFE RECHARGEABLE LITHIUM-ION BATTERY

R&D STATUS REPORT 1931-1003/0

ARPA Order No.: 9332004arp01/13APR1994/313ES
Program Code No.: ARPA-BAA93-32
Contractor: The Electrofuel Manufacturing Company Inc.
Contract No.: N00014-94-C-0141 Contract Amount: \$1271728.
Effective Date of Contract: August 15, 1994
Expiration Date of Contract: February 14, 1996
Principal Investigator: J.K. Jacobs
Telephone No.: (800) 388-2865
Short Title of Work: Lithium-ion Battery Development
Reporting Period: December 16, 1994 to January 15, 1995

Description of Progress:

Fabrication of batteries using the prototype and pilot lines will require substantially larger quantities of active cathode materials (lithium manganese oxides and alternate lithiated transition-metal oxides). Thus, a suitable furnace for the high temperature reaction had been planned, and designed. Construction of this equipment is now complete. The furnace has been commissioned and is currently undergoing testing with 1, 2, and 5 kg batch sizes.

The design of the prototype web handling equipment is now complete and fabrication has started. It will be in the form of a three-section modular unit with an unwind/coating module, a hot-air drying tunnel, and a multipurpose (laminating, slitting, rewind, strip-stack, etc.) module. All are of cantilever design except the laminator, and are designed to handle webs from 1 to 8 inches wide.

Studies leading to a stack-pressure control methodology have been successfully completed. This includes separator design and verification and current collector adhesion verification. The separator is a gel-impregnated microporous polymer with good mechanical strength and penetration resistance.

Construction of the baseline button cells is well underway with a group of 20 cells scheduled to be completed in early February.

Forming cycles and a characterization cycle will be performed immediately thereafter.

Construction of the first hand-crafted cells is starting, slightly ahead of schedule. These will be made on the lab bench in single-sheet form for verification of assembly method. Although it is not expected that these cells will have representative performance characteristics (due to inevitable variations and imperfections in the hand-crafting process) cell cycling will be attempted as material becomes available.

Change in Key Personnel: None

Summary of Substantive Information Derived from Special Events:
None:

Problems Encountered and/or Anticipated: None

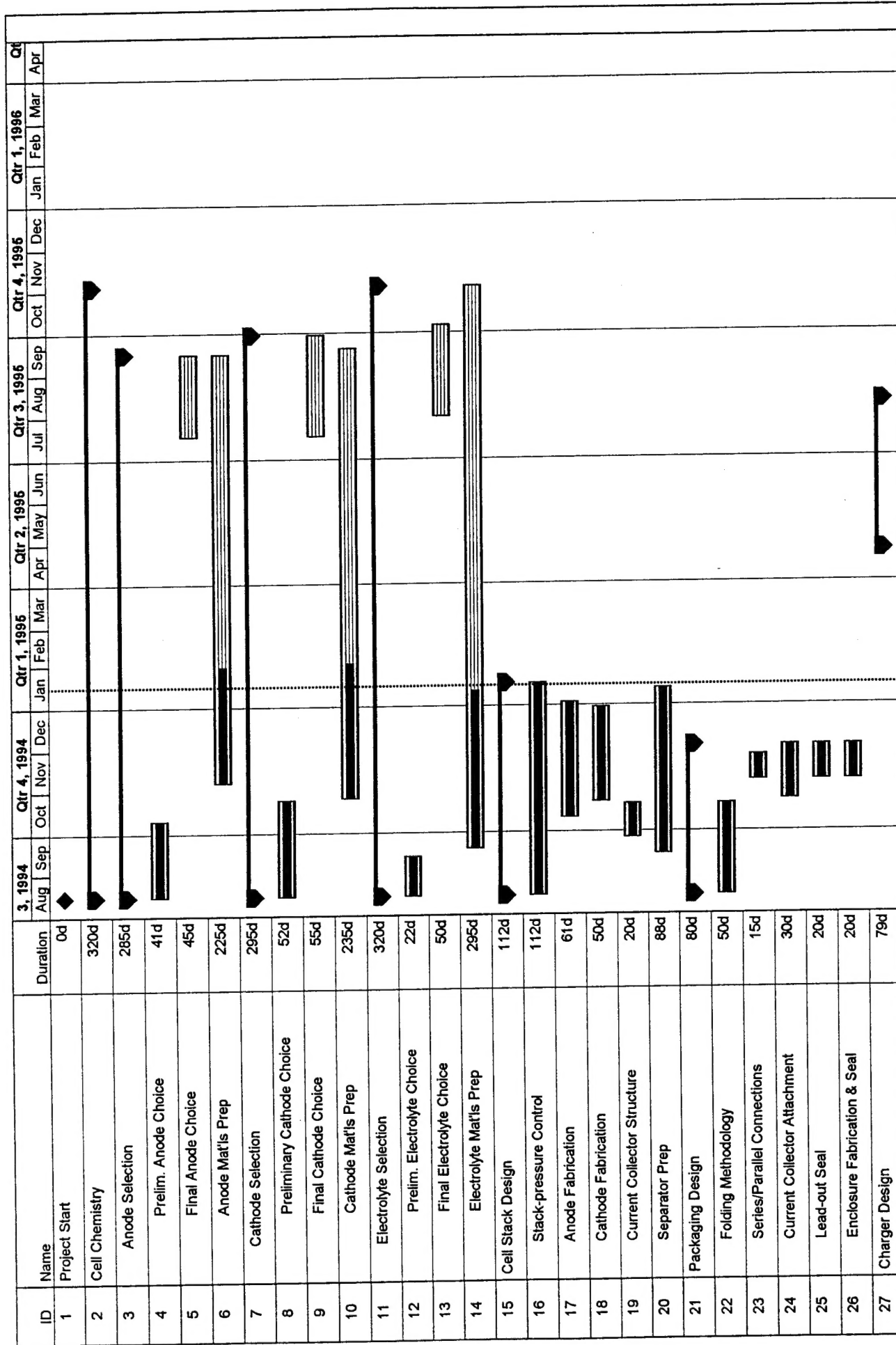
Action Required by the Government: None

Fiscal Status:

Total Estimate of Program	US Govt Funding Obligation	Electro fuel Contribution
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(1) Amt. currently provided on contract:	\$1630421	\$1271728	\$358693
(2) Expenses & commitments to date:	\$ 239916	\$ 187134	\$ 52782
(3) Funds required to complete work:	\$1390505	\$1084594	\$305911

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 Progress
 Critical
 Noncritical
 Milestone
 Summary
 Rolled Up

Project: Li-Ion Battery
 Date: 1/26/95

ID	Name	Duration	3, 1994			Qtr 4, 1994			Qtr 1, 1995			Qtr 2, 1995			Qtr 3, 1995			Qtr 4, 1995			Qtr 1, 1996			Qtr
			Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	
28	Safety Requirements Review	44d																						
29	Safety Protection Design	35d																						
30	Equalization	61d																						
31	Rate Control	45d																						
32	User-group Input	360d																						
33	User Input - part I	60d																						
34	User Input - part II	60d																						
35	User Input - part III	60d																						
36	Flexible Manufacturing Line Design	155d																						
37	Prototype Equipment Design	55d																						
38	Pilot Equipment Design	50d																						
39	Misc. Unit Op.'s Equip. Design	40d																						
40	Flexible Manufacturing Line Setup	155d																						
41	Prototype Line Setup	50d																						
42	Pilot Line Setup	55d																						
43	Battery Fabrication	265d																						
44	Button Cell	30d																						
45	Hand-crafted Cell	35d																						
46	Prototype Battery A: Credit Card	30d																						
47	Prototype Battery B: Lap Top	15d																						
48	Prototype Battery C: B5590	20d																						
49	Battery Testing	250d																						
50	Button Cell Performance	20d																						
51	Hand-crafted Performance	15d																						
52	Prototype Safety	20d																						
53	Prototype Performance	35d																						
54	Reporting	390d																						

Summary

Rolled Up

Progress

Milestone

Critical

Noncritical

Project: Li-ion Battery

Date: 1/26/95

ID	Name	Duration	3, 1994	Qtr 4, 1994	Qtr 1, 1995	Qtr 2, 1995	Qtr 3, 1995	Qtr 4, 1995	Qtr 1, 1996	Qtr
55	Progress	360d	Aug Sep	Oct Nov Dec	Jan Feb Mar	Apr May Jun	Jul Aug Sep	Oct Nov Dec	Jan Feb Mar	Apr
56	Button Cell Report	15d								
57	Prototype Battery Test Report	20d								
58	Final Report	20d								
59	Project Complete	0d								

Project: LI-Ion Battery
Date: 1/26/95

Critical

Noncritical

Progress

Milestone

Summary

Rolled Up